

RECREATION AND CONSERVATION IN THE AQUATIC ENVIRONMENT

By J. C. WHARTON

Fisheries and Wildlife Department,
605 Flinders Street, Melbourne, Victoria 3000, Australia

Introduction

In planning this symposium, it was thought that some aspects of the competition between domestic, industrial and recreational uses of water might be brought out by the various speakers. The recreational uses of the aquatic environment which suffer most because of other demands are fishing and hunting and I will therefore confine my remarks to these, but it is hardly appropriate to talk of the relationship between fishing, hunting and other water uses as being competitive in any real sense, and the basic reason for this is the difficulty of measuring the value of recreation in comparable terms. It is possible to produce figures showing that a hunter spends a certain amount of money to shoot a duck, and that the total expenditure involved in catching a fish may be hundreds of dollars, but it is impossible as yet to indicate the true value of any recreational activity to the individual. By comparison, the value of agricultural use of water can be measured conveniently in terms of production per unit of water and the end product of industry is also measurable in similar terms.

Assessment of the value of recreation to human beings probably awaits the application of behavioural studies, along similar lines to those commonly employed for animals such as rats. The general results of this work leave no doubt that crowding of individuals produces radical changes in behaviour patterns and no-one can seriously doubt that changes of this sort do occur in human beings when they are crowded together. One widely accepted means of relieving the tensions that most city dwellers have experienced is to fish or hunt whenever an opportunity can be made.

As an alternative to putting a value on the recreational uses of water, an attempt will be made simply to describe the changes which have occurred in the aquatic environment of south-eastern Australia since the days of first settlement and to note the effects of these changes on fish, waterfowl and other animals.

It is unfortunate indeed that the effects of these environmental changes on man himself cannot be taken into account.

The Aquatic Environment Before Settlement

The aquatic environment is all of the water within the land limits of our continent together with the animals and plants that live in it or depend very closely on it. Included are the bays and estuaries, the ocean waters overlying the continental shelf, the muds, sands and clays that may underly the water and all of the life they contain.

It is impossible to give any precise details of the aquatic environment in the time before the coming of Europeans, but the major elements of the scene probably

can be described without too much error and an attempt will be made to give the general features of the Murray River System and its tributaries.

Summer was a time of low streams and rivers were sometimes reduced to a series of deep holes with flow between them below the surface of the river bed. The water was generally warm and clear. Most waterways had a well-developed backwater system of billabongs and swamps and some had fairly extensive lakes associated with them. Some of these areas held water over the summer.

Winter and spring were usually periods of relatively high river flow resulting from general rains and from melting snow on the south-eastern highlands. The water was cold and in the lower reaches of the river system, it was probably turbid. Most years, the backwater systems and lakes filled with water and in some years, the river flooded and extensive areas in the river valley were covered with water for varying periods.

There was an abundance of trees, logs and debris in all streams and this was probably re-arranged a good deal with each flood that occurred. Rivers had extensive marginal areas of trees and shrubs.

In several parts of Victoria, there were very large areas of poorly drained land which were not connected directly with any river and these retained water for considerable periods.

The animals and plants of south-eastern Australia evolved in this rigorous aquatic environment. There are 23 species of native fish and their life cycles are very closely related to the seasonal pattern of change in their particular habitats.

Large numbers of water birds and other animals and plants depended on the filling of backwater systems for food, shelter and breeding areas, and a great variety of animals such as fish, amphibians, reptiles, birds and invertebrates lived in these areas. A rich and diverse fauna inhabited the forest and scrub country bordering the rivers and this habitat in turn depended on occasional inundation for its continued existence.

A very approximate estimate of the major dimensions of the pristine environment in Victoria is indicated in Table I.

Factors that have changed the Aquatic Environment

There are six general ways in which the aquatic environment has been changed and each of these will be considered.

(a) WATER CONSERVATION

In the Murray-Darling River System, there are now more than ten large dams, four water diversion structures, thirteen locked weirs and more than 5000 miles of irrigation canals. About twenty off-river natural lakes or swamps involving a total of some 50,000 acres have been modified for use as water storages.

All of the big dams are in headwaters of the river system and they form large lakes with some of the water that would normally have entered downstream backwaters in winter or spring. Water is released from the dams at a fairly constant rate during the summer months for irrigation purposes and rivers often run at a high level. Because the water comes generally from the bottom of the lakes, it may be 15°F cooler than water running into the dam and it may run for many miles downstream before warming appreciably.

In autumn, irrigation flows cease and the dams begin to store the normal flows of winter and spring. The effect of big dams and the regulation of river flow below them is to reverse the natural pattern of low summer and high winter flows. The extent of river regulation in Victoria is shown in Table I and Fig. 1.



FIG. 1—REGULATED RIVERS OF VICTORIA

TABLE I
THE AQUATIC ENVIRONMENT IN VICTORIA
Major Physical Changes

Environmental Feature	Pristine Condition	1968	The Foreseeable Future
Major rivers (12,000 miles)	Natural flow	22% of annual flow regulated (2,100* miles of river course) 1,350 miles subject to river improvement works	47% of annual flow regulated by the year 2000 Extension of areas subject to river improvement works are planned
River-fed swamps and billabongs	Surface area of 300,000 acres	River relationship with most areas changed by regulation of flow and by levees and drainage 50,000 acres converted to water storages 10,000 acres managed as water-fowl reserves	Further loss of area and change of relationship with river
Other swamplands	Surface area of 500,000 acres	300,000 acres drained 70,000 acres managed as waterfowl reserves	Drainage of further areas
Artificial water storages	None	160,000 acres (surface area)	275,000 acres by the year 2000

* Includes Murray River.

Dams isolate the upstream populations of animals from those living downstream except in those rare cases where a fishway or ladder is provided. There are two fishways on the Murray River at the present time and these are the only structures of this sort in south-eastern Australia.

Irrigation canals take water and the life it contains into new areas, but like the controlled rivers which fill them, they are quite dissimilar to our original aquatic environment.

The use of relatively shallow off-river lakes as permanent storages for irrigation water usually makes these lakes completely unsuitable for the animals and plants which formerly used them. In fact, they are new environments that are used mostly by introduced species of fish.

(b) FLOOD CONTROL

Major dams play their part in flood control, but there are other means of minimizing the effects of flooding and in Victoria, considerable effort is directed towards improving the carrying capacity of streams for flood waters and of speeding the run-off from flooded lands. These activities are called river improvement and drainage works and the first involves the 'snagging' of waterways to remove logs and other debris. Snagging is often followed by erosion control works and this may include the removal of standing trees which are likely to fall into rivers, the building of groynes to prevent bank erosion and often the straightening of a river course so as to make it more like a channel. At present, nearly 1400 miles of Victorian rivers are subject to river improvement and this mileage is divided about equally between coastal streams and those flowing into the Murray. The location of the various river improvement areas is shown in Fig. 2. About 75% of the total river distance indicated has been subject to snagging and some 25% of this also has been given erosion control works.

(c) POLLUTION

Most of us have seen obvious acts of pollution such as factory effluent discolouring a river, spray drift from an aircraft being carried by wind as a visible cloud far beyond its target area, and of oil slicks accumulating on some seashore along with animals that have been maimed or killed. Less obvious but equally serious pollution occurs when salty drainage water from irrigation areas finds its way into rivers, when water is taken from a river in large quantities to cool some industrial operation and returned with sufficient gained heat to warm the whole river by 10°F or so, or when sewage effluent is discharged into a natural water.

The effects of heated water and factory wastes on the aquatic environment are most damaging during periods of low river flow, but at any level, there is a substantial reduction in the number and variety of life forms that can exist.

Pesticides are extremely toxic to fish, aquatic animals, and to birds and terrestrial animals, and the misuse of these materials on or near a river is always followed by deaths in one or more of the animal groups mentioned. Fish deaths are sometimes extensive and quite obvious, but other animals are much harder to see for they often die in places which are hidden from normal view. With pesticides, there is also a danger that animals which survive may be permanently affected in other ways. For example, their capacity to reproduce may be impaired.

Purified sewage effluent contains phosphates and nitrates and when it enters natural waters, it has the same effect as the addition of fertiliser and increases the capacity of the water to support both animal and plant life. However, if this process of 'enrichment' or 'eutrophication' as it is called goes on without being checked, the character and appearance of the water concerned may be completely changed. Clear

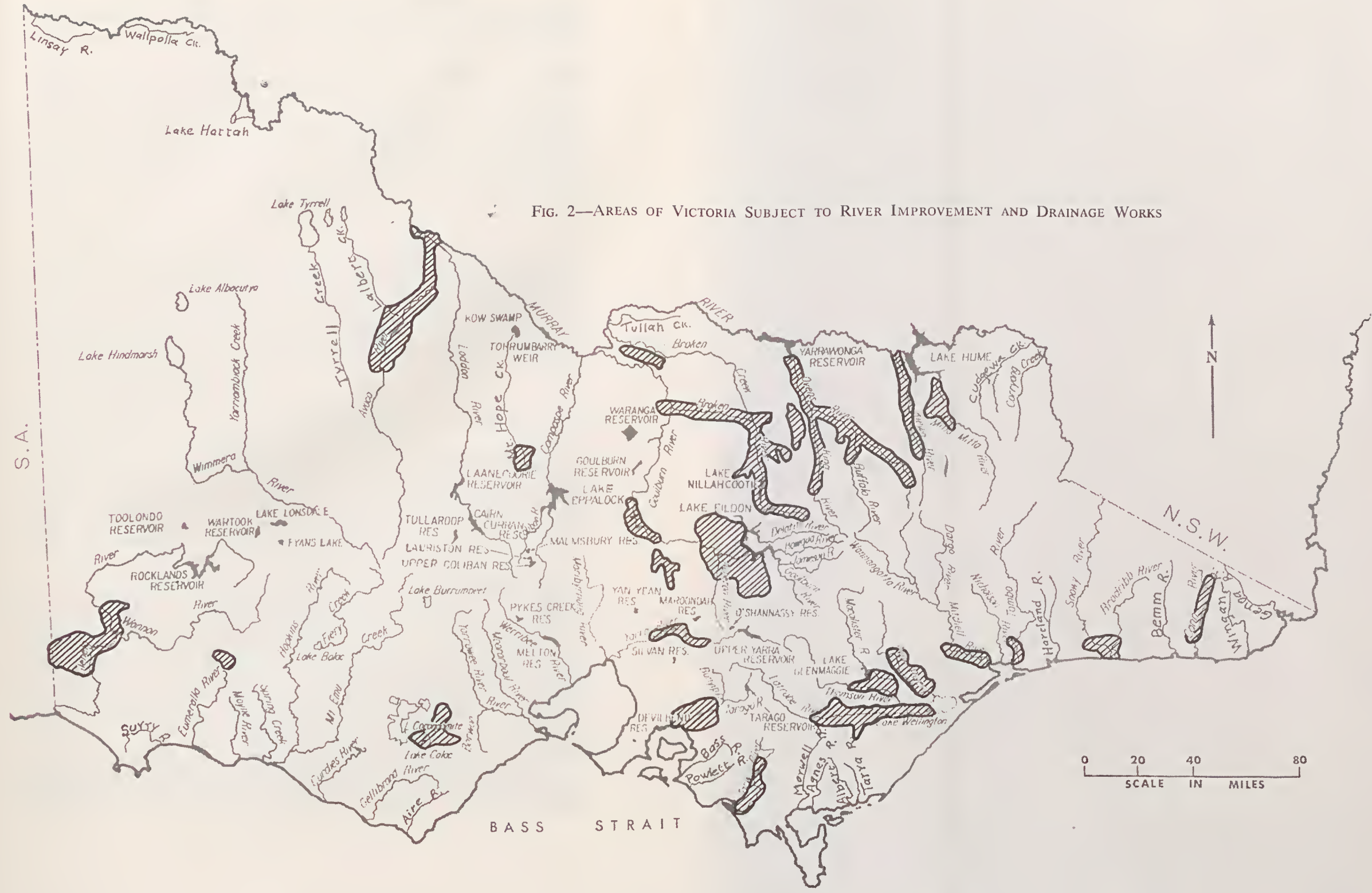


FIG. 2—AREAS OF VICTORIA SUBJECT TO RIVER IMPROVEMENT AND DRAINAGE WORKS



Linsay R.

Wallpolla Ck.

Lake Hartah

Lake Tyrrell

Lake Albotra

Lake Hindmarsh

S.A.

MURRAY RIVER

Tullah Ck.

Broken

Waranga Reservoir

Goulburn Reservoir

Lake Eppalock

Lake Nillahcootie

Lake Fildon

Yarra River

Upper Yarra Reservoir

Lake Wenmaggie

Tarago Reservoir

Lake Wellington

Devil's Hole Reservoir

Basin Reservoir

Powlett Reservoir

Basin Reservoir

Yarra River

Yarra Reservoir

Yarra Reservoir

Yarra Reservoir

Yarra Reservoir

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N.S.W.

BASS STRAIT

